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ABSTRACT

This lesson, which is part of a course in electronics technology, explains the workings of a black-and-white television. It covers the structure and function of the 18 structural blocks of black-and-white television sets. The following materials are included: a lesson plan, transparency masters, and student handouts. The lesson plan includes lists of references, student equipment and required dress, equipment and audiovisual aids required, objectives, special remarks, and an instructional outline that is cross-referenced with methods of instruction and aids. (MN)

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ED339796

BLOCK DIAGRAM OF A BLACK AND WHITE TV

LESSON PLAN NO. 1

Donald S. Hollandsworth

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LESSON PLAN

LESSON PLAN NO. 001		NAME: McKinley High School		PAGE <u>1</u> OF <u>24</u> PAGES																					
COURSE OF INSTRUCTION AND COURSE NUMBER: Electronics Tech 1 ACCN VI31			TOTAL HOURS: 50 minutes	LESSON TITLE: Block Diagram of a Black and White TV																					
DAY AND DATE OF INSTRUCTION: 3 November 1988 Thursday			HOURS 1:30 - 2:20	PLACE: Room 213 Wist Hall University of Hawaii - Manoa																					
NO. OF STUDENTS: 30	REHEARSAL: 1 November 1988 Tuesday	INSTRUCTOR AND ASSISTANTS: Donald S. Hollandsworth		STUDENT MATERIAL AND DRESS: Notebook, pencil, pen.																					
REFERENCES: Richard W. Tinnell; <u>Professional TV Servicing Methods</u> , Cleveland Institute of Electronics Inc., 1974, p.13-20. Joseph G. Sloop; <u>Television Servicing with Basic Electronics</u> , Indianapolis, Howard W. Sams Co., 1981, p.21-29.			EQUIPMENT AND AUDIO-VISUAL AIDS: <table border="0"> <tr> <td>1. Overhead Projector</td> <td>11. Chart</td> </tr> <tr> <td>2. Transparencies #1-9.</td> <td>12. Pointer</td> </tr> <tr> <td>3. Screen</td> <td>13. Transparency Pens</td> </tr> <tr> <td>4. Chalkboard</td> <td>14. Transparency Pointer</td> </tr> <tr> <td>5. Chalk</td> <td></td> </tr> <tr> <td>6. B&W or Color TV</td> <td></td> </tr> <tr> <td>7. Small Screwdriver</td> <td></td> </tr> <tr> <td>8. $\frac{1}{4}$" Nut Driver</td> <td></td> </tr> <tr> <td>9. Definition Handout.</td> <td></td> </tr> <tr> <td>10. Block Diagram Handout</td> <td></td> </tr> </table>			1. Overhead Projector	11. Chart	2. Transparencies #1-9.	12. Pointer	3. Screen	13. Transparency Pens	4. Chalkboard	14. Transparency Pointer	5. Chalk		6. B&W or Color TV		7. Small Screwdriver		8. $\frac{1}{4}$ " Nut Driver		9. Definition Handout.		10. Block Diagram Handout	
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OBJECTIVES: At the completion of this lesson the student should be able to: (1). Identify and list at least ten of the eighteen blocks in a Black and White television set. (2). Describe the functions of at least five out of the eighteen blocks.			SPECIAL REMARKS: 1. Set up and test the overhead projector. 2. Set up the TV with the back cover removed and power disconnected.																						

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
1. Introduction. A. <u>Objectives.</u> At the completion of this lesson you should have a conceptual understanding of block diagrams and how a Black and White Television operates. B. <u>Standards.</u> At the completion of this lesson you should also be able to: 1) Identify and list at least ten of the eighteen blocks in a Black and White television set. 2) Describe the functions of at least five out of the eighteen blocks. C. <u>Reasons.</u> Question: Can I see a show of fingers how many TV sets you each have in your house? Question: How much do you think the average repair cost is on a TV set? Answer: \$100-\$125. Question: How much could you save by repairing your own TV sets? Block diagrams are extremely useful to the television technician. They help him to organize his thinking about what goes on in a television set and they help him to locate troubles within the set. We will study the block diagram of a black and white set as a preliminary to learning about color television. This information will assist you in correcting problems on your own personal televisions and can save you substantial repair bills in the future.	5 min	Opening Discussion Require students to take notes. Questions.

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
2. Explanation. A. <u>Sections of a Television Set.</u> (1) The television receiver has two inputs and two outputs. a. Inputs: 1. Antenna - Intercepts the incoming signal. 2. Power from the electric plug. b. Outputs: 1. Speaker - Provides the sound. 2. Picture Tube - Provides the picture. (2) To make it easier to learn the blocks in a television set, we can separate them into the following groups: a. Video IF circuits. b. Audio circuits. c. Sweep circuits. d. Power Supply circuits. B. <u>The Block Diagram of a Black and White TV.</u> (1) Define Block Diagram - A diagram of a system, instrument, computer, or program in which selected portions are represented by annotated boxes and interconnecting lines. (2) Define Signals - The electronic impulses which carry information from place to place. (3) Define Coupled - Connected, a signal is coupled from one block to another.	40 min	Distribute Block Diagram and Definition Handout. Show Transparency No. 1. Show Transparency No. 2. Show Transparency No. 3.

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
C. <u>Video IF Circuits:</u> The first seven blocks of the Block Diagram provide the picture producing circuits. These are the Antenna, IF Amplifier, Video Detector, Video Amplifier, Automatic Gain Control and Picture Tube.		Point out blocks on chart.
(1) <u>Antenna Block:</u>		
a. Intercepts the signal from the station.		Show Transparency No. 4.
b. Applies the signal to the tuner input.		Demonstrate location of tuner.
(2) <u>Tuner Block:</u>		
a. Selects the channel.		
b. Amplifies the signal.		
c. Allows for fine tuning.		
d. Applies the signal to the IF Amplifiers.		
(3) <u>IF Amplifiers Block:</u>		
a. Increases the Intermediate Frequency signal strength.		
b. IF - Intermediate Frequency.		
(4) <u>Video Detector Block:</u>		
a. Separates the information signal from the radio of TV waves that carry it through space.		
b. Define Video - The picture information.		

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
(5) <u>Video Amplifiers Block:</u> Breaks the signal into the following parts: Video Signal, Sound Signal, Automatic Gain Signal, and Picture Synchronizing Signal. a. The Video Signal is the picture information which is amplified then sent to the picture tube. b. The Sound Signal is a FM, frequency modulated, radio signal which carries the sound information to the Sound IF block. c. The Automatic Gain Control signal is developed by sampling the strength of the sync pulses received, then is sent to the AGC block. d. The Picture Synchronizing Signals are sent from the TV station to keep the receiver in step with the camera. This signal is sent to the Sync Separator. (6) <u>Automatic Gain Control Block:</u> Adjusts the set automatically so that both weak and strong stations produce good pictures. (7) <u>Picture Tube Block:</u> Produces a picture using the Video Signal, Vertical Sweep Signal, Horizontal Sweep Signal, and the High-Voltage.		Show Transparency No. 5. Demonstrate loss of Video. (screen lit but no information) Demonstrate contrast effect. (ratio of lite to dark) Demonstrate brightness effect. (intensity of video signal) Show Transparency No. 4. 12

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
Summary of Video IF circuits: (1) Antenna intercepts the television signal. (2) Tuner selects the channel and amplifies the signal. (3) IF Amplifiers amplify the Intermediate Frequency. (4) Video Detector separates the information signal from the radio of TV waves that carry it through space. (5) Video Amplifier breaks the signal into four separate parts: Video Signal, Sound Signal, AGC Signal, and Picture Synchronizing Signals. (6) AGC controls the gain for weak and strong stations. (7) Picture Tube produces a picture.		Show Transparency No. 6. Sketch review of Video If Circuits on Transparency No. 6.

PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
D. <u>The Audio Circuits</u> The Audio Circuits consist of the following four blocks; Sound IF Amplifier, Sound Detector, Audio Amplifier, and Speaker. Together these blocks reproduce the sound that is associated with the picture. (1). <u>Sound IF Amplifier Block:</u> Amplifies the Sound signal and sends it to the Sound Detector. (2). <u>Sound Detector Block:</u> Separates the sound impulses from the FM radio signal then sends the impulses to the Audio Amplifier. (3). <u>Audio Amplifier Block:</u> Amplifies the sound impulses then sends them to the speaker. (4). <u>Speaker Block:</u> Converts the audio impulses into audible sound. Summary of Audio Circuits: Now we have covered 11 of the 18 blocks. Question: Can you name the four Audio Circuits ? Answer: Sound IF, Sound Detector, Audio Amplifier; and Speaker.		Show Transparency No. 7. Demonstrate Audio Amplification. Sketch review of Audio Circuits on Transparency No. 6.

PRESENTATION

OUTLINE OF INSTRUCTION

TIME

METHODS OF INSTRUCTION AND AIDS

E. Sweep Circuits.

The sweep circuits consist of the following five blocks; Sync Separator, Vertical Sweep, Automatic Frequency Control, Horizontal Oscillator, and Horizontal Output. Together they produce the scanning raster which is synchronized with the station signal.

(1). Sync Separator Block:

Separates the vertical- and horizontal-sync signals.

- a. Describe Sync Signals - Picture synchronizing signals, vertical and horizontal.
- b. Describe scanning - creating the picture.

(2). Vertical Sweep Block:

Develops the Vertical Sweep signal, based on the rate of the vertical sync signal. This signal drives the vertical deflection coils on the CRT.

(3). AFC Block:

Automatic Frequency Control ensures correct horizontal scanning rate based on the horizontal sync signal.

(4). Horizontal Oscillator Block:

Develops the signal which scans the picture horizontally.

(5). Horizontal Output Block:

- a. Develops the signal power needed to scan the picture tube.
- b. Drives the High-Voltage Power Supply.

Point out blocks on chart.

Show Transparency No. 8.

Demonstrate a change in vertical sweep frequency by adjusting the vertical hold control.

Demonstrate a change in horizontal sweep frequency by adjusting the horizontal hold control.

PRESENTATION

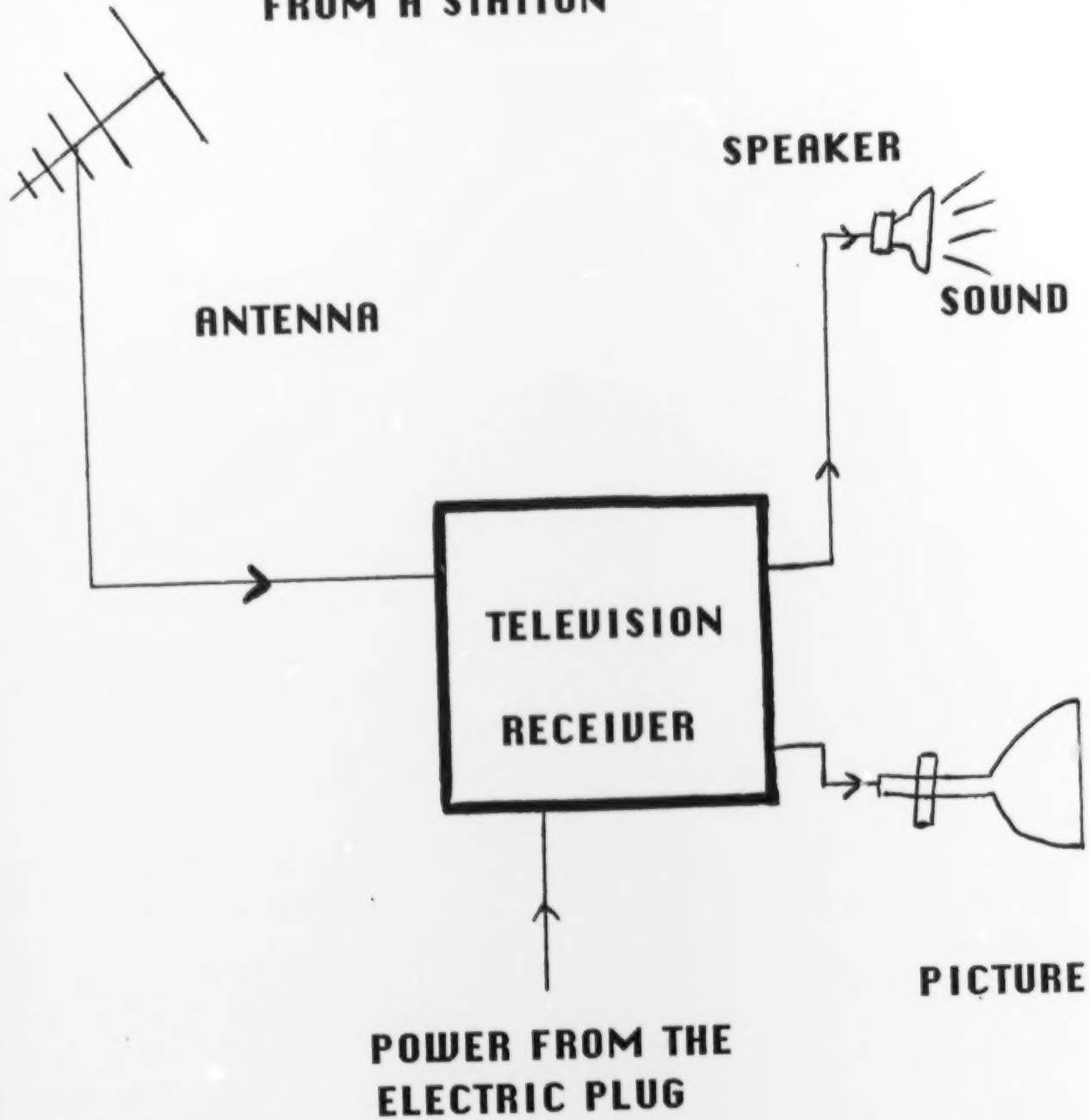
OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
Summary of Sweep Circuits: 1. Sync Separator separates the vertical- and horizontal-sync signals. 2. Vertical Sweep develops the vertical sweep signal. 3. AFC ensures correct horizontal scanning rate, 15,734 Hz. 4. Horizontal Oscillator develops the signal which scans the picture horizontally. 5. Horizontal Output develops the signal power to scan the picture tube and drive the high voltage power supply. Now 16 blocks in three groups have been covered. Video IF Circuits - 7 blocks. Audio Circuits - 4 blocks. Sweep Circuits - 5 blocks. Question: Can you name each of the Sweep circuits? Answer: Sync Separator, Vertical Sweep, AFC, Horizontal Oscillator, and Horizontal Output. 10		Sketch review of Sweep Circuits on Transparency No. 6. 20

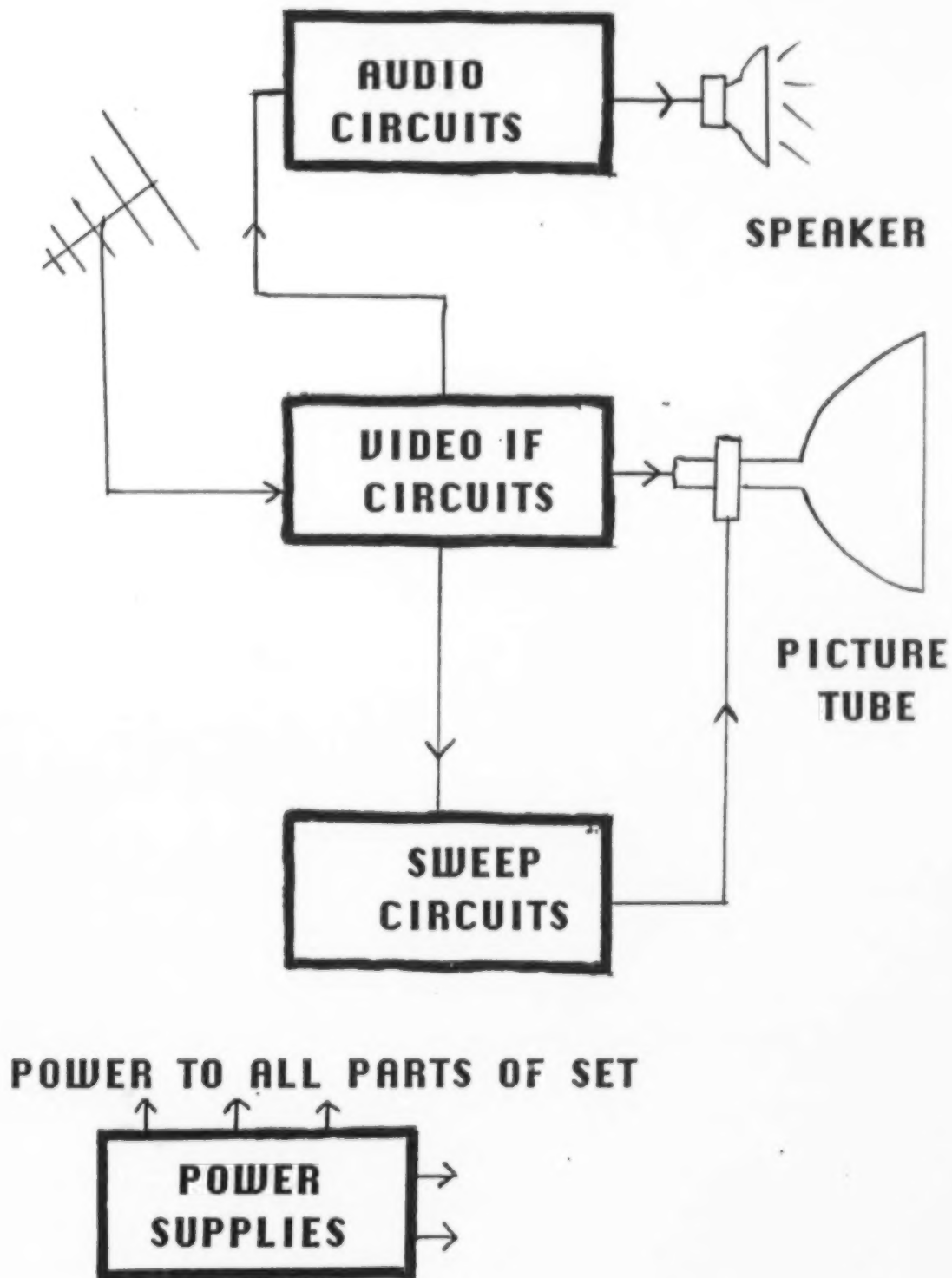
PRESENTATION

OUTLINE OF INSTRUCTION	TIME	METHODS OF INSTRUCTION AND AIDS
F. <u>Power Supply Circuits:</u> The last two blocks in our diagram are Power supplies which provide operating voltages for the television set. (1) <u>The Low Voltage Power Supply Block</u> provides the operating voltages to all stages of the TV set. (2) <u>The High Voltage Power Supply Block</u> provides a very high voltage, approximately 14KV, for the operation of the picture tube. --- HIGH VOLTAGE CAN KILL --- Summary of Power Supply Circuits: Listed above. 3. Summary. The television receiver block diagram can be useful to the service technician. It allows him to trace the signal path through the television set. The technician can often tell which part of the set has stopped working just by observing the external symptoms. Now you also can isolate problems in a television set, and save money in the process.	5 min	Show Transparency No. 9. Demonstrate the on-off switch. Demonstrate the location of High Voltage. Sketch review of Power Supply Circuits on Transparency No. 6. Open for student questions. Closing statement.

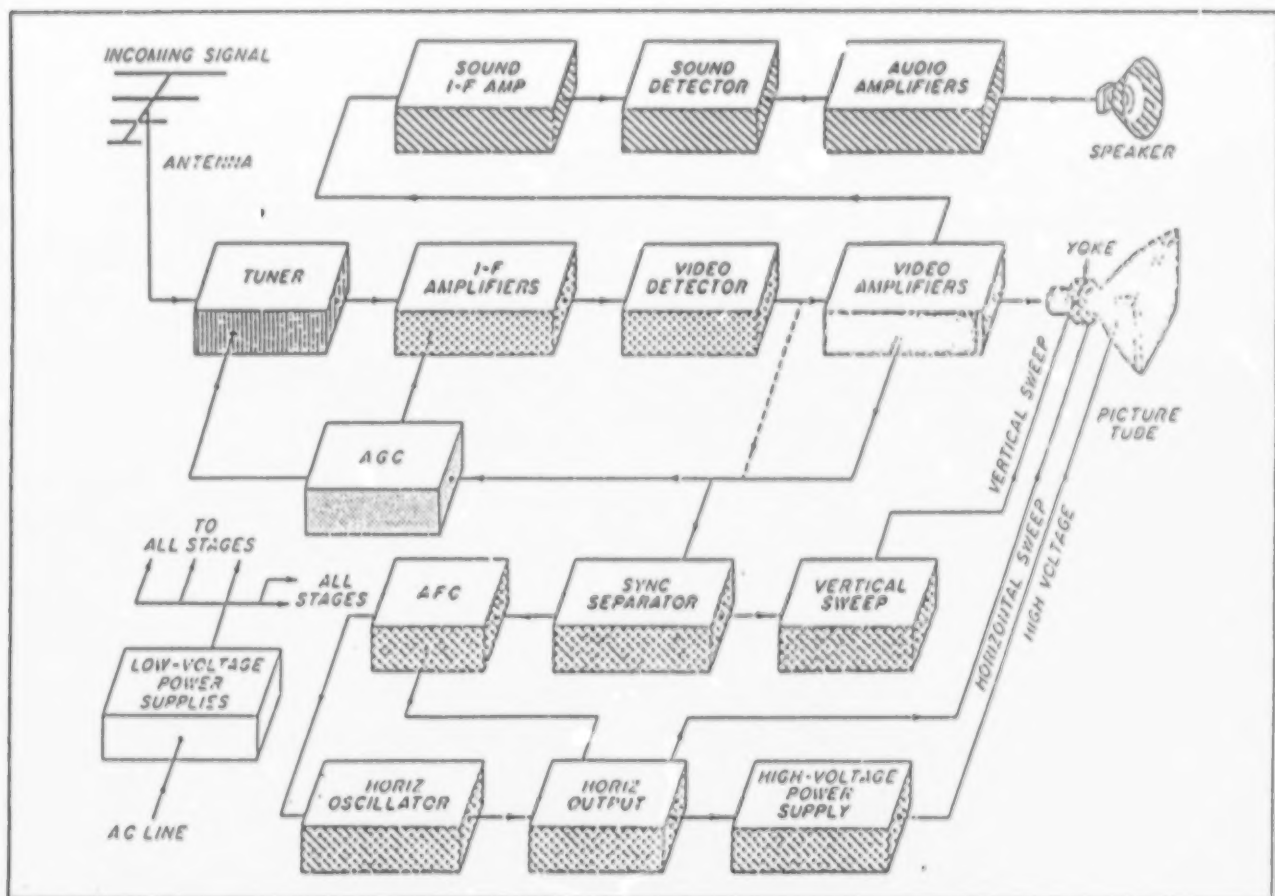
Transparency #1

**INCOMING SIGNAL
FROM A STATION**





Transparency #3

BLOCK DIAGRAM OF A
BLACK AND WHITE TV SET

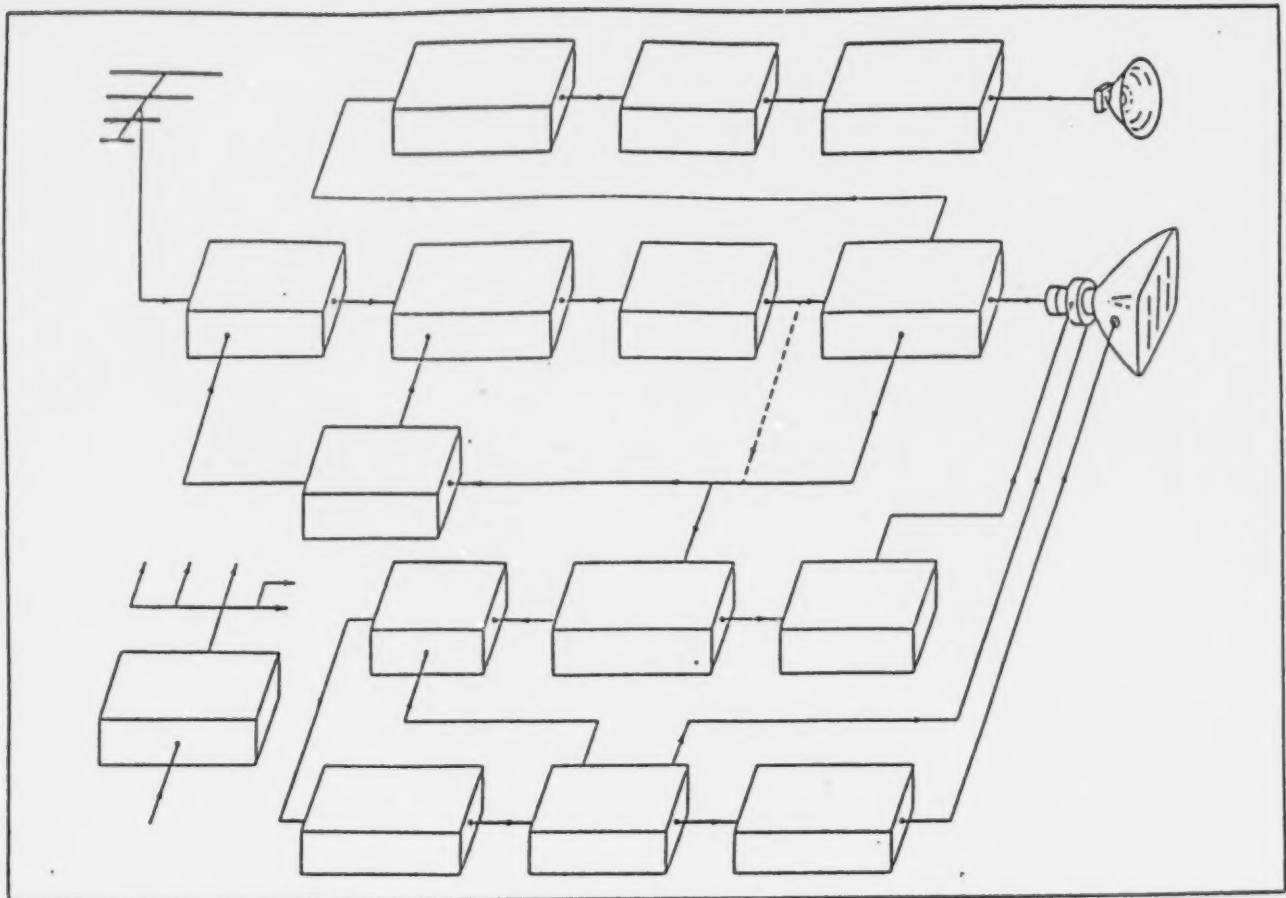
VIDEO IF CIRCUITS:

- 1. ANTENNA - INTERCEPTS THE TELEVISION SIGNAL.**
- 2. TUNER - SELECTS THE CHANNEL AND AMPLIFIES THE SIGNAL.**
- 3. IF AMPLIFIERS - AMPLIFY THE INTERMEDIATE FREQUENCY.**
- 4. VIDEO DETECTOR - SEPARATES THE INFORMATION SIGNAL FROM THE RADIO OF TV WAVES THAT CARRY IT THROUGH SPACE.**
- 5. VIDEO AMPLIFIER - BREAKS THE SIGNAL INTO FOUR PARTS; VIDEO, SOUND, AGC, AND PICTURE SYNCHRONIZING SIGNALS.**
- 6. AGC - CONTROLS THE GAIN FOR WEAK AND STRONG STATIONS.**
- 7. PICTURE TUBE - REPRODUCES A PICTURE.**

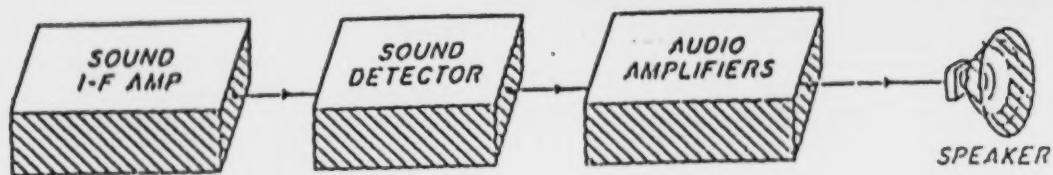
Transparency #5

VIDEO AMPLIFIERS - BREAK THE SIGNAL INTO FOUR SEPARATE SIGNALS.

1. THE VIDEO SIGNAL - PICTURE INFORMATION. THIS SIGNAL IS AMPLIFIED BY THE VIDEO AMPLIFIERS THEN IS SENT TO THE PICTURE TUBE.
2. THE SOUND SIGNAL. AN FM RADIO SIGNAL WHICH CARRIES THE SOUND INFORMATION AND IS SENT TO THE SOUND IF STAGE.
3. AUTOMATIC GAIN CONTROL SIGNAL - ADJUSTS THE SET AUTOMATICALLY SO THAT BOTH WEAK AND STRONG STATIONS PRODUCE GOOD PICTURES. THIS SIGNAL IS SENT TO THE AGC STAGE.
4. PICTURE SYNCHRONIZING SIGNALS - SIGNALS WHICH ARE SENT FROM THE TV STATION TO KEEP THE RECEIVER IN STEP WITH THE CAMERA.



Transparency #7

**AUDIO CIRCUITS:****1. SOUND IF AMPLIFIER -**

AMPLIFIES THE SOUND SIGNAL.

2. SOUND DETECTOR -

SEPARATES THE SOUND IMPULSES FROM THE FM RADIO SIGNAL.

3. AUDIO AMPLIFIER -

AMPLIFIES THE SOUND IMPULSES AND SENDS THEM TO THE SPEAKER.

4. SPEAKER -

CONVERTS THE AUDIO IMPULSES INTO AUDIBLE SOUND.

SWEEP CIRCUIT FUNCTIONS:

- 1. SYNC SEPARATOR SEPARATES THE VERTICAL- AND HORIZONTAL-SYNC SIGNALS.**
- 2. VERTICAL SWEEP DEVELOPS THE VERTICAL SWEEP SIGNAL.**
- 3. AFC ENSURES CORRECT HORIZONTAL SCANNING RATE.**
- 4. HORIZONTAL OSCILLATOR DEVELOPS THE SIGNAL WHICH SCANS THE PICTURE HORIZONTALLY.**
- 5. HORIZONTAL OUTPUT DEVELOPS THE SIGNAL POWER TO SCAN THE PICTURE TUBE AND DRIVE THE HIGH VOLTAGE POWER SUPPLY.**

POWER SUPPLIES

LOW VOLTAGE POWER SUPPLY -

**PROVIDES THE OPERATING VOLTAGES
TO ALL STAGES OF THE TV SET.**

HIGH VOLTAGE POWER SUPPLY -

**PROVIDES THE OPERATING VOLTAGE
FOR THE PICTURE TUBE.**

- DANGER HIGH VOLTAGE CAN KILL -

Definition Handout No. 1

Name _____
Last , FirstBlocks:Terms:Functions:Descriptions:

Video IF Circuits:

Antenna

Any device used to intercept radio or television signals.

Automatic Frequency

A section which regulates the Horizontal Control scanning rate. (side to side)

Automatic Gain

Controls the gain for weak and strong Control stations.

IF Amplifiers

Increases the signal strength of the intermediate frequency.

Picture Tube

Reproduces the scene being telecast from the television station.

Video Amplifiers

Breaks the signal in to four parts: Video Signal, Sound Signal, AGC Signal, and Picture Synchronizing Signal.

Video Detector

Separates the information signal from the radio of TV waves that carry it through space.

Tuner

Selects the channel and amplifies the signal.

Amplify

To make a signal stronger.

Block Diagram

A diagram of a system, instrument, computer, or program in which selected portions are represented by annotated boxes and interconnecting lines.

Coupled

Connected - A signal is coupled from one block to another.

Detect

To separate an information signal from the radio or TV waves that carry it through space.

Gain

To make a signal stronger.

IF

Intermediate frequency.

Signals

The electronic impulses which carry information from place to place in a circuit.

Video

Picture Information

Definition Handout (cont.)

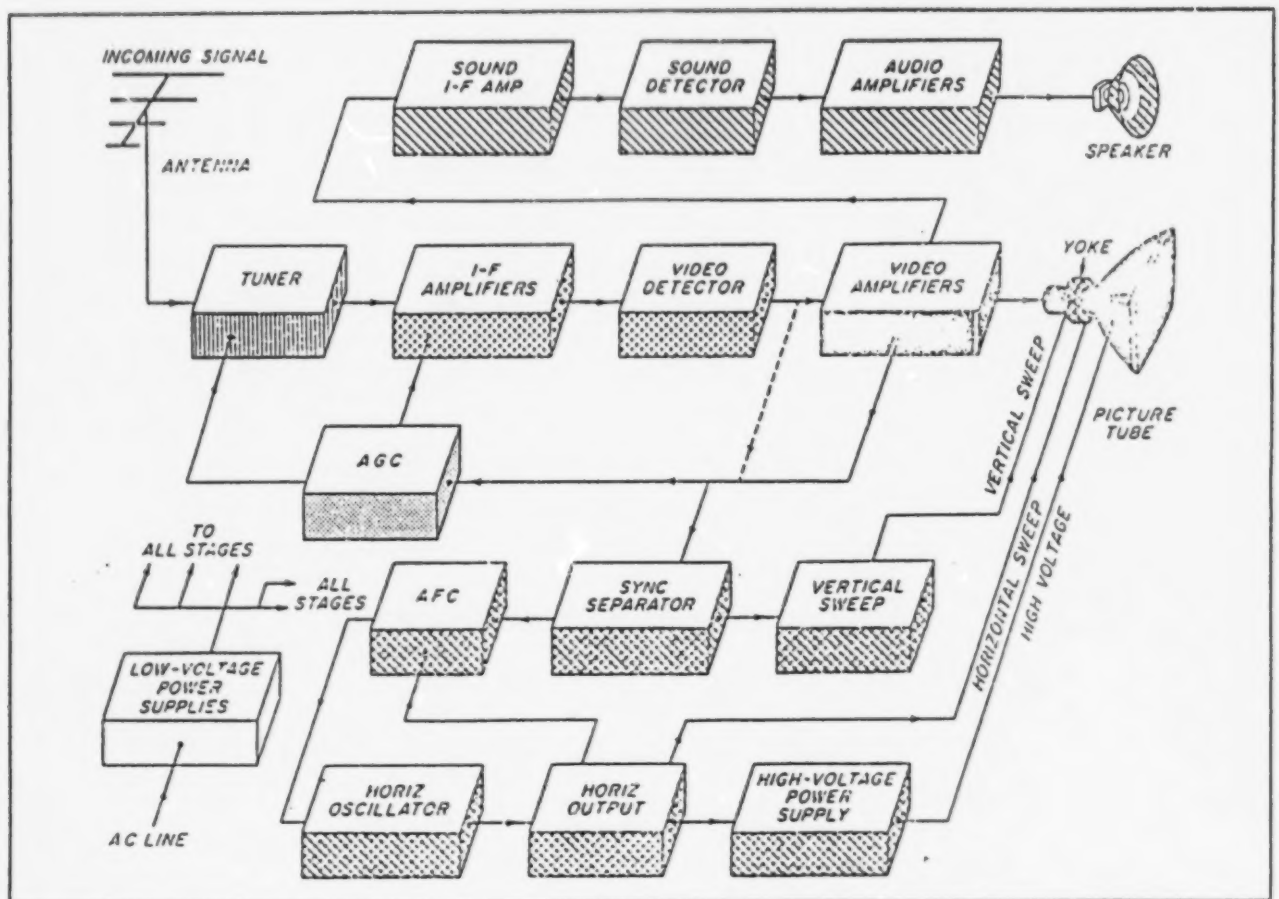
Audio Circuits:

Audio Amplifiers	Amplifies the sound impulses and sends them to the speaker.
Sound Detector	Separates the sound impulses from the FM radio signal.
Sound IF Amplifier	Amplifies the Sound Signal.
Speaker	Converts the audio impulses into sound.
Sound Signal	An FM, frequency modulated, radio signal which carries the sound information.
Horizontal Oscillator	Generates the horizontal scanning signal. (side to side)
Horizontal Output	Provides the power needed to operate the picture tube.
Sweep Circuits: Vertical Sweep	Provides synchronization of the picture vertically. (top to bottom)
Sync Separator	Separates the vertical- and horizontal-sand signals.
Horizontal Sync	Synchronization of the picture horizontally. (side to side) 15,734 Hz
Scan	Sweeping the beam; vertical force pulls the beam left to right, while the horizontal force moves it top to bottom.
Sync Signals	Picture synchronizing signals sent from the TV station to keep the receiver in step with the camera.
Vertical Sync	Synchronization of the picture vertically. (top to bottom) 59.94 Hz
Power Supply Circuits: High-Voltage Power Supply	Provides the operating voltage for the picture tube.
Low-Voltage Power Supply	Provides operating voltages to all sections of the TV set.

11/3/88 dsh

Tinnell Richard W.: Television Symptom Diagnosis

Block Diagram Handout No. 2

BLOCK DIAGRAM OF A
BLACK AND WHITE TV SET

Block Diagram Practice Exercise:

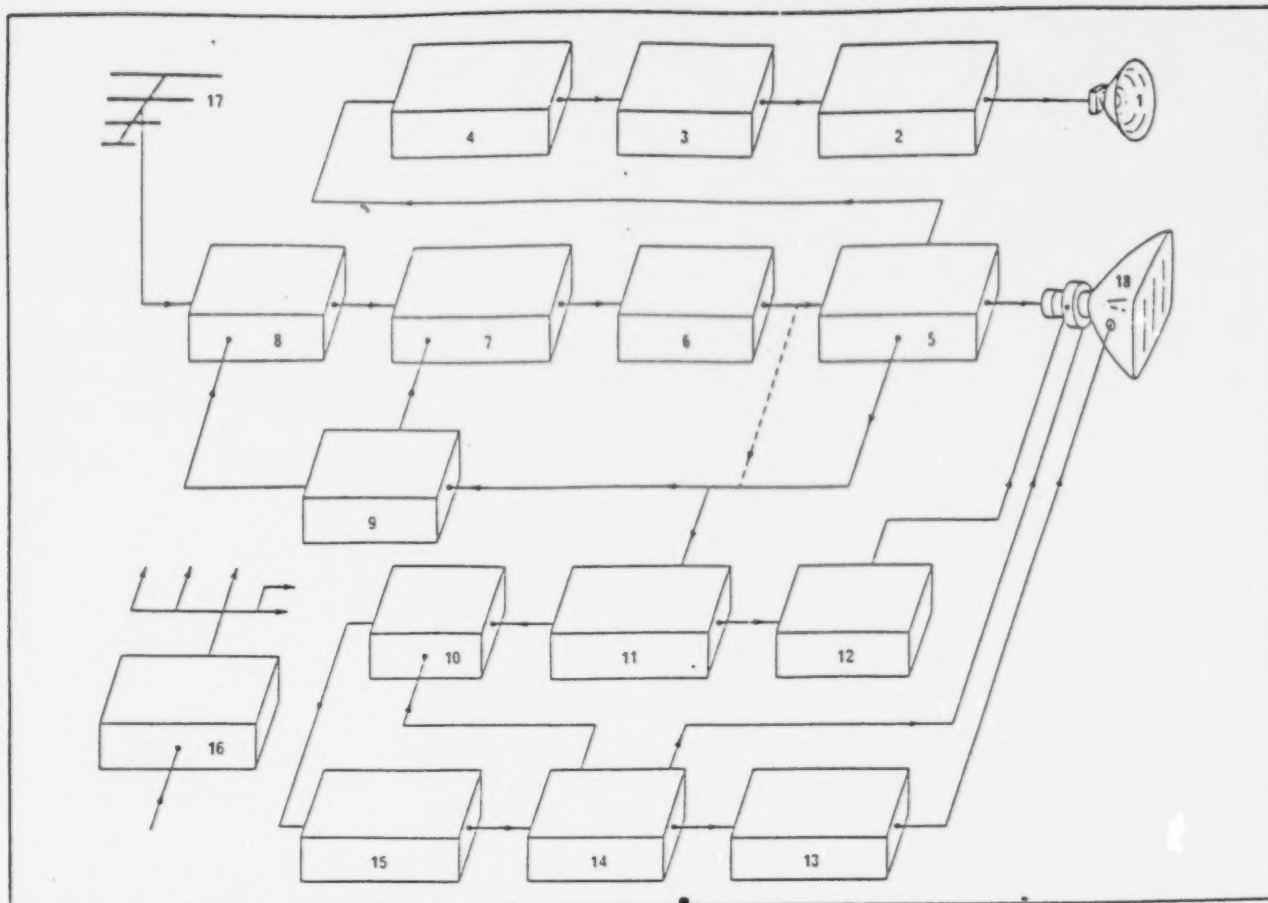


Fig. 1-2. Block diagram of a black-and-white TV receiver.

Write the letter for each control in its correct block location.

- | | |
|-------------------|----------------------|
| A. on-off switch | E. vertical hold |
| B. volume control | F. channel selector |
| C. contrast | G. fine tuning (vhf) |
| D. brightness | |

Write the name of each numbered block in Fig. 1-2 beside the numbers given below.

- | | |
|----------|-----------|
| 1. _____ | 10. _____ |
| 2. _____ | 11. _____ |
| 3. _____ | 12. _____ |
| 4. _____ | 13. _____ |
| 5. _____ | 14. _____ |
| 6. _____ | 15. _____ |
| 7. _____ | 16. _____ |
| 8. _____ | 17. _____ |
| 9. _____ | 18. _____ |

Block Diagram Practice Exercise:

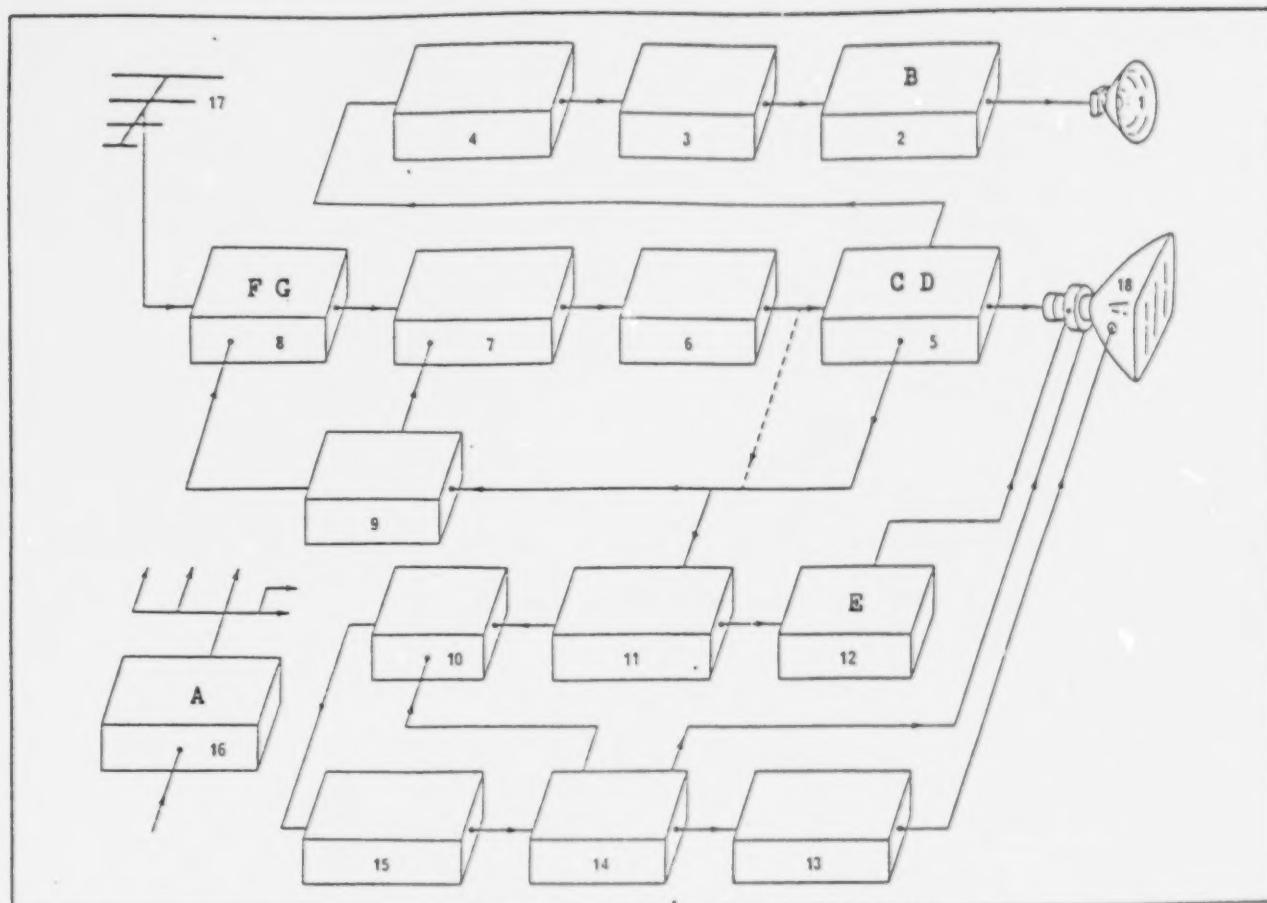


Fig. 1-2. Block diagram of a black-and-white TV receiver.

Write the letter for each control in its correct block location.

- | | |
|-------------------|----------------------|
| A. on-off switch | E. vertical hold |
| B. volume control | F. channel selector |
| C. contrast | G. fine tuning (vhf) |
| D. brightness | |

Write the name of each numbered block in Fig. 1-2 beside the numbers given below.

- | | |
|----------------------------|--------------------------------------|
| 1. <u>Speaker</u> | 10. <u>AFC</u> |
| 2. <u>Audio Amplifier</u> | 11. <u>Sync Separator</u> |
| 3. <u>Sound Detector</u> | 12. <u>Vertical Sweep</u> |
| 4. <u>Sound IF Amp</u> | 13. <u>High Voltage Power Supply</u> |
| 5. <u>Video Amplifiers</u> | 14. <u>Horizontal Output</u> |
| 6. <u>Video Detector</u> | 15. <u>Horizontal Oscillator</u> |
| 7. <u>IF Amplifiers</u> | 16. <u>Low Voltage Power Supply</u> |
| 8. <u>Tuner</u> | 17. <u>Antenna</u> |
| 9. <u>AGC</u> | 18. <u>Picture Tube</u> |